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Space Charge Distribution in Two-layer Dielectrics

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Silicone rubber and ethylene propylene diene monomer (EPDM) are widely used in accessory of cross-linked polyethylene (XLPE) power cable. The prepared two-layer dielectric samples comprise two different thin slabs of silicone rubber and EPDM with XLPE, respectively. Space charge distribution in above two samples, pre-stressed at a dc voltage for a certain period, are measured by pulsed electro-acoustic method before and after being short-circuited. Observation shows that the magnitude of charge peaks at interface between two dielectrics increases under lower electric stress and decrease under higher electric stress with voltage application time, and the charge peak of silicone rubber-XLPE sample is higher than EPDM-XLPE sample. However, after being short-circuited, the result shown is contrary. It is considered that the charge trap density at interface of silicone rubber-XLPE sample is less than that of EPDM-XLPE sample. The charge polarity is dependent on the polarity of electrode next to silicone rubber or EPDM slab. Under low electric stress, polarity of space charges in silicone rubber or EPDM slab is the same as the interfacial charge, but the both polarities in XLPE slab is opposite. Under high electric stress, the charges of hetero-polarity are formed in dielectric material next to electrode.

It is found that silicone grease spread on the interface between two-layer dielectric materials weakens the peak of interfacial charge and accelerates the formation of hetero-polar charge in dielectric material next to the electrode.

The formation process of interfacial charges is assumed as migration of charges